

FORM PTO-1390  
(REV. 9-2001)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

**10/030626**

INTERNATIONAL APPLICATION NO.  
PCT/EP00/06715

INTERNATIONAL FILING DATE  
July 14, 2000

PRIORITY DATE CLAIMED  
July 14, 2000

TITLE OF INVENTION  
CONSTRUCTION MACHINE AND MILLING ROLLER

APPLICANT(S) FOR DO/EO/US  
Olaf Gaerther, Guenter Haehn and bernd Holl

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☒ has been communicated by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☒ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11 to 20 below concern document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

U.S. APPLICATION NO. 107030626 INTERNATIONAL APPLICATION NO.

ATTORNEY'S DOCKET NUMBER

21. ☐ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

CALCULATIONS PTO USE ONLY

\$ 890.00

\$

Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)). ☐ 20 ☐ 30

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$
Total claims	33 - 20 =	13	x \$18.00	\$ 234.00
Independent claims	1 - 3 =	0	x \$84.00	\$ 0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$ 0

TOTAL OF ABOVE CALCULATIONS =

\$ 1124.00

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.

\$

SUBTOTAL =

\$ 1124.00

Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)). ☐ 20 ☐ 30

\$

TOTAL NATIONAL FEE =

\$ 1124.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$

TOTAL FEES ENCLOSED =

\$ 1124.00

Amount to be refunded:

\$

charged:

\$

- a. ☒ A check in the amount of \$ 1124.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1716. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

DILLER, RAMIK & WIGHT  
 7345 McWhorter Place; Suite 101  
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SIGNATURE

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NAME

20,663

REGISTRATION NUMBER

Dated: January 11, 2002

531 Rec'd PROV 11 JAN 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PCT Patent Application of:

Olaf GAERTNER et al.

PCT/EP00/06715

International Filing Date: July 14, 2000  
Filed in DO/US: **January 11, 2002**

## CONSTRUCTION MACHINE AND MILLING ROLLER

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January 11, 2002

Box PCT  
Commissioner for Patents  
Washington, D.C. 20231

## PRELIMINARY AMENDMENT

Sir:

Contemporaneously with the filing of the above-captioned PCT designated office patent application and prior to examination on the merits thereof, please amend the application as follows:

**IN THE SPECIFICATION:**

Please substitute pages 1, 3, 4. and 5 attached herewith which are English translations of the Preliminary Examination amendment.

Page 1, (substitute sheet), before line 1, insert the following heading:

**- - TITLE OF THE INVENTION - -:**

Page 1 (substitute sheet), before the first paragraph (between lines 1 and 2), insert the following heading:

**-- BACKGROUND OF THE INVENTION -- ;**

Page 1 (substitute sheet), cancel the first full paragraph (lines 3 and 4).

Page 4 (substitute sheet), before the first paragraph (line 1), insert the following heading:

**-- SUMMARY OF THE INVENTION --.**

Page 7, between lines 19 and 20, insert the following heading:

**-- BRIEF DESCRIPTION OF THE DRAWINGS --.**

Page 8, between lines 8 and 9, insert the following heading:

**-- DESCRIPTION OF THE PREFERRED EMBODIMENTS --.**

Page 13, after the last line, please insert the following new paragraph:

(New) Although a preferred embodiment of the invention has been specifically illustrated and described herein, it is to be understood that minor variations may be made in the apparatus without departing from the spirit and scope of the invention, as defined the appended claims.

**IN THE CLAIMS**

Please substitute attached pages 14 through 18 containing claims 1 through 28 as the translated Preliminary Examination amendment claims.

Before claim 1 (substitute page 14) , insert the following new paragraph:

**-- What is claimed is: --**

Claims 3 through 8, 12, 13, 15 through 21, 23 through 28 (substitute), please rewrite as follows:

3. (Amended) The milling roller according to claim 1, characterized in that the milling tube (25) is fastened to an end side of the roller base body (19) and is radially supported on the other end side.
4. (Amended) The milling roller according to claim 1, characterized in that the fastening elements (28) comprise flange members projecting radially inward from the milling tube (25).
5. (Amended) The milling roller according to claim 1, characterized in that the milling tube (25) is arranged at a radial distance from the roller base body.
6. (Amended) The milling roller according to claim 1, characterized in that the milling tube (25) axially projects relative to the roller base body (19).
7. (Amended) The milling roller according to claim 1, characterized in that the member connected to the roller base body (19) comprises the transmission unit (32) integrated into the roller base body (19).

8. (Amended) The milling roller according to claim 1, characterized in that the milling tube (25) is radially supported at two axially spaced positions on the roller base body (19).
12. (Amended) The milling roller according to claim 9, characterized in that the radial guide elements can comprise radially acting tensioning elements (60, 62, 64).
13. (Amended) The milling roller according to claim 1, characterized in that, between the milling tube (25) and the roller base body (19), at least one support ring (33) is arranged as a radial guiding element.
15. (Amended) The milling roller according to claim 13, characterized in that the at least one support ring (33) is arranged for axial displacement relative to the roller base body (19) and the milling tube (25).
16. (Amended) The milling roller according to claim 14, characterized in that the segment rings (62, 62, 64) are wedge-shaped in cross section.

17. (Amended) The milling roller according to claim 13, characterized in that the at least one support ring (33) comprises a central ring (60) having a trapezoidal shape in cross section and arranged to be axially tensioned against a radially outer ring (62) and a radially inner ring (64) which have an opposite trapezoidal shape in cross-section, and pressing the outer ring (62) against the milling tube (25) and the inner ring (64) against the roller base body (19).
18. (Amended) The milling roller claim 13, characterized in that the at least one support ring (33) is divided into two or more parts in the circumferential direction.
19. (Amended) The milling roller according to claim 1, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing toward the milling roller drive device (11 to 15).
20. (Amended) The milling roller according to claim 1, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing away from the milling roller drive device (11 to 15), and the transmission unit (32) being connected to the milling roller drive device (11 to 15) by a shaft (56) guided through the roller base body (19).

21. (Amended) The milling roller according to claim 1, characterized in that the roller base body (19) is supported in two side walls (16, 17) of a roller box (31), the side wall (17) facing away from the milling roller drive device (11 to 15) can be displaced by one of a pivoting and axis-parallel movement, and the pivotable side wall (17) in the closed condition receives the movable bearing (24) of the roller base body (19).
23. (Amended) The milling roller according to claim 1, characterized in that the roller base body (19) is supported in two side walls (16, 17) of a roller box (31), and a machine cover (21) arranged on the milling roller drive device (11 to 15) is provided with openings (23) allowing access to fastening elements (20) between the side wall (16) facing toward the milling roller drive device (11 to 15) and the transmission unit (32) without a demounting of machine parts.
24. (Amended) The milling roller according to claim 1, characterized in that the free end of the milling tube (25) is provided with a protective sleeve (39) for the inner surface (44).
25. (Amended) The milling roller according to claim 13, characterized in that the protective sleeve (39) projects from the supporting ring (33).
26. (Amended) The milling roller according to claim 1, characterized in that the roller base body (19) is surrounded by a protective tube (38).

27. (Amended) The milling roller according to claim 13, characterized in that the protective tube (38) comprises recesses (37) arranged in a uniform distribution at predetermined axial distances on the circumference, for receiving the support ring (33).
28. (Amended) The construction machine comprising a machine frame (2) having a milling roller (18) according to claim 1 arranged or supported therein.

Please add the following new claims:

29. (New) The milling roller according to claim 11, characterized in that the radial guide elements can comprise radially acting tensioning elements (60, 62, 64).
30. (New) The milling roller according to claim 14, characterized in that the at least one support ring (33) is arranged for axial displacement relative to the roller base body (19) and the milling tube (25).
31. (New) The milling roller according to claim 15, characterized in that the segment rings (62, 62, 64) are wedge-shaped in cross section.
32. (New) The milling roller according to claim 24, characterized in that the protective sleeve (39) projects from the supporting ring (33).

33. (New)The milling roller according to claim 26, characterized in that the protective tube (38) comprises recesses (37) arranged in a uniform distribution at predetermined axial distances on the circumference, for receiving the support ring (33).

**IN THE ABSTRACT OF THE DISCLOSURE:**

Cancel line 1 in its entirety (the title); and

Cancel last line in its entirety ("(Fig. 1)").

**R E M A R K S**

Commensurate with the filing of this application, the Examiner is respectfully requested to introduce this amendment in order that the proper headings are inserted, all multiple dependent claims cancelled, the new Abstract of the Disclosure inserted and both the government filing fee and examination are based upon the claims of record after the introduction of the present amendment.

The claims of record for prosecution of the United States national phase are claims 1 through 33. The present amendment herewith cancels the multiple dependent claims and adds new claims 29 through 33 to cover the cancelled subject matter by way of the dependency thereof from claim 12, 15, 16, 25 and 33.

Upon entry of this amendment, favorable consideration on the merits of the claims is respectfully solicited.

Respectfully submitted,  
DILLER, RAMIK & WIGHT

By: 

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Attachment: Marked-up Claims

New Application:  
Filed National Phase:  
PCT/EP00/06715

Olaf Gaertner et al.  
January 11, 2002

### MARKED-UP CLAIMS

#### Amended claims

3. (Amended) The milling roller according to [any one of claims 1 or 2] claim 1, characterized in that the milling tube (25) is fastened to an end side of the roller base body (19) and is radially supported on the other end side.
4. (Amended) The milling roller according to [any one of claims 1 to 3] claim 1, characterized in that the fastening elements (28) comprise flange members projecting radially inward from the milling tube (25).
5. (Amended) The milling roller according to [any one of claims 1 to 4] claim 1, characterized in that the milling tube (25) is arranged at a radial distance from the roller base body.
6. (Amended) The milling roller according to [any one of claims 1 to 5] claim 1, characterized in that the milling tube (25) axially projects relative to the roller base body (19).
7. (Amended) The milling roller according to [any one of claims 1 to 6] claim 1, characterized in that the member connected to the roller base body (19) comprises the transmission unit (32) integrated into the roller base body (19).

8. (Amended) The milling roller according to [any one of claims 1 to 7] claim 1, characterized in that the milling tube (25) is radially supported at two axially spaced positions on the roller base body (19).
12. (Amended) The milling roller according to [any one of claims 9 or 11] claim 9, characterized in that the radial guide elements can comprise radially acting tensioning elements (60, 62, 64).
13. (Amended) The milling roller according to [any one of claims 1 to 12] claim 1, characterized in that, between the milling tube (25) and the roller base body (19), at least one support ring (33) is arranged as a radial guiding element.
15. (Amended) The milling roller according to claim 13 [or 14], characterized in that the at least one support ring (33) is arranged for axial displacement relative to the roller base body (19) and the milling tube (25).
16. (Amended) The milling roller according to claim 14 [or 15], characterized in that the segment rings (62, 62, 64) are wedge-shaped in cross section.

17. (Amended) The milling roller according to [any one of claims 13 to 16] claim 13, characterized in that the at least one support ring (33) comprises a central ring (60) having a trapezoidal shape in cross section and arranged to be axially tensioned against a radially outer ring (62) and a radially inner ring (64) which have an opposite trapezoidal shape in cross-section, and pressing the outer ring (62) against the milling tube (25) and the inner ring (64) against the roller base body (19).
18. (Amended) The milling roller [according to any one of claims 13 to 17] claim 13, characterized in that the at least one support ring (33) is divided into two or more parts in the circumferential direction.
19. (Amended) The milling roller according to [any one of claims 1 to 28] claim 1, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing toward the milling roller drive device (11 to 15).
20. (Amended) The milling roller according to [any one of claims 1 to 18] claim 1, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing away from the milling roller drive device (11 to 15), and the transmission unit (32) being connected to the milling roller drive device (11 to 15) by a shaft (56) guided through the roller base body (19).

21. (Amended) The milling roller according to [any one of claims 1 to 20] claim 1, characterized in that the roller base body (19) is supported in two side walls (16, 17) of a roller box (31), [that] the side wall (17) facing away from the milling roller drive device (11 to 15) can be displaced by one of a pivoting [or] and axis-parallel movement, and [that] the pivotable side wall (17) in the closed condition receives the movable bearing (24) of the roller base body (19).
23. (Amended) The milling roller according to [any one of claims 1 to 22] claim 1, characterized in that the roller base body (19) is supported in two side walls (16, 17) of a roller box (31), [that] and a machine cover (21) arranged on the milling roller drive device (11 to 15) is provided with openings (23) allowing access to fastening elements (20) between the side wall (16) facing toward the milling roller drive device (11 to 15) and the transmission unit (32) without a demounting of machine parts.
24. (Amended) The milling roller according to [any one of claims 1 to 23] claim 1, characterized in that the free end of the milling tube (25) is provided with a protective sleeve (39) for the inner surface (44).
25. (Amended) The milling roller according to claim 13 [and 24], characterized in that the protective sleeve (39) projects from the supporting ring (33).
26. (Amended) The milling roller according to [any one of claims 1 to 25] claim 1, characterized in that the roller base body (19) is surrounded by a protective tube (38).

27. (Amended) The milling roller according to claim 13 [and 26], characterized in that the protective tube (38) comprises recesses (37) arranged in a uniform distribution at predetermined axial distances on the circumference, for receiving the support ring (33).
28. (Amended) The construction machine[, preferably] comprising a machine frame (2) having a milling roller (18) according to [any one of claims 1 to 27] claim 1 arranged or supported therein.

Da/Dt

Construction machine and milling roller

The invention relates to a milling roller according to the preamble of claim 1 and a construction machine according to claim 28, respectively.

Different situations at construction sites and different milling processes make it often necessary to adapt the milling tool to the specific tasks. For instance, when a specific surface roughness is to be obtained, a milling roller with a special line interval of the milling tools or a different tool equipment will be required. In another application, only lanes of specific widths have to be built, thus requiring a milling roller of a specific working width.

Normally, in such situations, a special milling machine has to be used, or the machine must be equipped with a milling roller adapted to the task. Presently, however, the exchange of the rollers is very bothersome and necessitates special auxiliary tools for the mounting and dismounting of the milling roller.

The adapting of milling rollers to different requirements is known in the state of the art.

DE 40 37 448 A describes a road milling machine wherein the roller body is braced between a fixed bearing carrying the drive housing, and a movable bearing arranged opposite to the fixed bearing. The movable bearing is provided with a centering receiving cone, and the support of the movable bearing can be hydraulically displaced. Further, the movable bearing is braced to the fixed bearing via a tie bar.

The approach known from DE 40 37 448 A requires a complex tensioning mechanism with a tie bar and a operating cylinder above the milling roller.

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Described in US-4,704,045 is a milling aggregate which is variable in width by use of various roller segments. According to this approach, the roller segments are connected to each other by a plug connection. In a certain manner, this approach can be considered as a milling roller quick-exchange system but suffers from the following disadvantages:

In this approach, it is disadvantageous that the milling rollers are driven hydrostatically by hydraulic motors arranged on both sides of the milling roller. Further, the connection between the segments is a simple plug connection allowing merely for an insufficient centering of the milling motor.

DE 31 45 713 A describes a milling roller for a road milling machine which is supported and driven by a roller bearing and drive device held by a support frame, wherein the milling roller comprises a cylindrical base body. Arranged on one end of the one-sided milling roller are the drive unit of the roller bearing and drive device as well as an annular shoulder supporting the milling tube mounted from the other end. On the side opposite to the drive unit, a holding flange is arranged for fixing the milling tube. According to this concept, the milling roller is provided with a hydrostatic drive which due to its system-inherent disadvantages, e.g. low efficiency, is nowadays hardly used any more in road milling. A further disadvantage of this approach resides in that the milling tubes have to be axially fixed by means of annular shoulders so that the fastening elements are located in the region of the strongest contamination.

US-4,720,207 describes milling tube segments mounted on a roller base body. In this concept, a corner ring segment is first applied on one side. Then the milling tube segments are attached thereon by screw-fitting, with the thread connection arranged within the segments. Disadvantages reside in the considerable expenditure for the screw connections and in that, due to the constant

diameter of the base body, the milling depth is restricted when a planetary gear is integrated into the base body.

A different approach wherein particularly the milling depth is not restricted, is described in US-5,505,598. According to this approach, the milling roller tube having the segments with the milling tools mounted thereon, has a stepped shape. The reason therefor is that the transmission required for a mechanical milling roller drive is integrated into the rotor. The planetary gear is arranged on the side opposite the belt drive disk and is driven by a drive shaft guided through the milling shaft.

This transmission arrangement is required to allow for a flush milling. In the region of the roller transmission, the diameter of the milling shaft is adapted corresponding to the constructional volume of the transmission. The rest of the region will then be available for the mounting of segments with the milling tools.

In this approach, it is disadvantageous that different milling processes, such as normal and fine milling, cannot be performed without exchanging the milling rotor.

Present milling rollers and inventions for adapting the milling tools to different applications are focused merely on the adapting of the milling rotor to the respective situation at the construction site.

A problem in the above mentioned state of the art normally resides in that the fastening elements for fixing the milling element to the base body are provided in the surface region of the cylindrical milling tool. Exactly this region, however, is subjected to massive contamination so that the exchange of the milling tube is rendered considerably difficult.

It is the object of the invention to provide a milling roller and a construction machine which allow for a fast exchange of milling rollers and a simplified handling of the demounted milling rollers and which minimize the time and work required for the exchange of a milling roller.

To achieve this object, a milling roller and a construction machine with the features of claim 1 and 28, respectively, are provided.

In the solution according to the invention, it is advantageously provided that the one-pieced milling tube comprises fastening elements, radially projecting from the inner surface, by which the milling tube can be mounted in a rotationally fixed manner to the roller base body or to a member connected to the roller base body. This solution offers the following advantages:

- For exchange of the milling tool, only the milling tube has to be exchanged.
- The fastening elements are arranged in the region of the least contamination.
- The roller drive with the mechanical milling roller drive elements remains in adjustment relative to the complete power train on the machine.
- Suitability of the device for different milling roller concepts.
- No adjustment of the power train required.
- Centering of the milling tube relative to the milling roller drive elements.
- Easily detachable connection between the milling tube and the milling tube drive element.

- Less expenditure for lifting equipment.
- Avoidance of imbalances due to axis displacement or angular displacement.

The fastening elements are preferably arranged on at least one end side of the milling tube. In this manner, for instance, the milling tube can be shifted onto the roller base body and be guided and centered by guide elements on the axial end of the roller base body opposite the fastening elements.

Preferably, the milling tube is attached on an end side of the roller base body. In this arrangement, the fastening elements are protected from contamination.

In an advantageous embodiment, the fastening elements comprise flange members projecting radially inward from the milling tube. Fastening screws are guided to extend axially through these flange members and are screwed into the end side of the roller base body.

The milling tube can be arranged at a radial distance from the roller base body. The thus remaining cylindrical hollow space can be used e.g. to fill water therein for cooling the milling roller.

Preferably, the milling tube is radially supported at two axially spaced positions on the roller base body. The support can be provided in the form of radial guide elements fastened either radially outside on the roller base body or radially inside on the milling tube. The guide elements comprise support rings or guide elements segmented in the peripheral direction, which guide rings can be arranged e.g. at mutual angular distances of  $120^\circ$ . The guide elements can have a conical (e.g. trapezoidal) shape, a spherical shape or a cylindrical shape when viewed in axial cross section.

Alternately, the support can comprise radial guide elements integrally connected to the at least one fastening element so that the fastening element will simultaneously effect the rotationally fixed axial connection between the milling tube and the roller base body, and the guidance and centering of the milling tube on the roller base body on one axial end.

The radial guide elements can comprise radially acting tensioning elements.

Preferably, the milling tube is of a one-pieced configuration.

Between the milling tube and the roller base body, there can be arranged at least one support ring comprising e.g. at least two radially tensioned segment rings.

This support ring can be arranged for axial displacement relative to the roller base body and the milling tube.

The segment rings of the support ring can be wedge-shaped in cross section.

The at least one support ring can comprise a central ring having a trapezoidal shape in cross section and arranged to be axially tensioned against a radially outer ring and a radially inner ring which have an opposite trapezoidal shape in cross section, and pressing the outer ring against the milling tube and the inner ring against the roller base body.

The at least one support ring can be divided into one or a plurality of parts when viewed in the peripheral direction. This facilitates the mounting of a support ring; for instance, the support ring can comprise two half-rings or segments of  $120^\circ$ .

In one embodiment, it is provided that the transmission unit is arranged at the end of the roller base body facing toward the milling roller drive device. In this

arrangement, the transmission unit is preferably integrated into the roller base body.

In another embodiment, it is provided that the transmission unit is arranged at the end of the roller base body facing away from the milling roller drive device, the transmission unit being connected to the milling roller drive device by a shaft guided through the roller base body. Also on this case, the transmission unit is integrated into the roller base body. Such a construction allows for the use of milling tubes with small milling widths.

The roller base body is supported in two side walls of a roller box, wherein the side wall facing away from the roller drive device can be displaced by a pivoting or axis-parallel movement. In the closed condition, the pivotable or axially displaceable side wall receives the movable bearing of the roller base body.

For this purpose, the movable bearing can comprise a guide member tapering in the outward direction, which is received and centered in a correspondingly tapering recess of the side wall.

Further advantageous embodiments of the invention are mentioned in the further claims.

Exemplary embodiments of the invention will be explained in greater detail hereunder with reference to the drawings.

Fig. 1 is a view of a road milling machine,

Fig. 2 is a schematic view of the milling roller drive device,

Fig. 3 is a view of a first embodiment of a milling roller supported in a roller box and having an exchangeable milling tube,

Fig. 4 is a view of a second embodiment of a milling roller supported in a roller box;

Fig. 5 is a view of a pivotable side wall of the roller box,

Figs. 6 and 7

are views of an alternative embodiment of the radial support of the milling tube,

Fig. 8 is a view of a third embodiment of a milling tube, and

Fig. 9 is a sectional view taken along the line IX-IX in Fig. 8.

Fig. 1 illustrates a road milling machine 1 for which the invention described hereunder is primarily used. Road milling machines normally comprise a chassis 2 with an internal combustion engine 11 mounted therein. The chassis of the machine normally comprises lifting columns 3,4, being adjustable in height and having support wheels or running chains 5,6 mounted thereon.

The milling aggregate 7 with the milling roller 18 is arranged under the chassis 2 and is rigidly connected thereto. The material detached by the milling roller is conveyed onto a first conveyer belt 9 which passes the material on to a second conveyer belt 10 which is adjustable in height and pivotable.

Fig. 2 illustrates the concept of the milling roller drive. An internal combustion engine 2 directly drives a pulley 13. Within this power train, there is normally arranged a pump distributor transmission 12 whereon the hydraulic pumps for the various hydrostatic drives are mounted. The engine power is transmitted via a composite V-belt 14 to a second pulley 15. This pulley is connected to a shaft which transmits the power to a planetary gear arranged within milling

roller 18 to reduce the rotational speed of the engine to the required roller speed. The milling roller is supported in the side walls 16 and 17.

Fig. 3 shows a first embodiment of a milling roller 18 supported in a roller box 31. The milling roller 18 comprises a roller base body 19 which by both of its axial ends is supported for rotation in the side walls 16,17 of the roller box 31, and a milling tube 25. For this purpose, the roller base body 19 receives, on an axial end thereof, the transmission unit 32 comprising a planetary gear and is connected therewith in a rotationally fixed manner. The fixed transmission transmission portion 22 of the planetary gear 32 is fastened to side wall 16 by means of a screw connection 20. An outer protective wall 21 can be provided, at the height of the screw connections 20, with openings 23 to allow access to the screw connections 20 from outside. On the axial end of the roller base body 19 opposite to the drive side, a movable bearing 24 is provided which by means of a guide member 40 is centrally supported in a recess 41 of the side wall 17. The guide member 40 and the recess 41 can have conical shapes adapted to each other so that the roller base body 19 with the movable bearing 24 is centrally supported in a simple manner.

For mounting the milling tube 25 on the roller base body 19, the milling tube 25 is shifted onto the roller base body 19. On the drive side of the roller base body 19, a radial guide element 26 is provided which on the one hand is attached to roller base body 19 and on the other hand serves as a screw-connection flange for planetary gear 32. The guide elements 26 can comprise an annular flange or ring segments which fill only a part of the peripheral region. The guide elements 26 are of a slightly conical, spherical or cylindrical cross section and can be welded to the roller base body 19. Generally, the radial support of the milling tube on the roller base body 19 can be provided by positive or frictional engagement. Alternatively, the guide elements 26 can comprise a splined shaft profile.

The guide elements 26 are arranged for centering the exchangeable milling tube 25. Preferred use is made of a conical or spherical cross-sectional shape so as to avoid a canting while mounting the milling tube 25.

Provided on the end of the roller base body 19 facing toward the movable bearing 24 is a radial support of the milling tube 25 by means of a fastening element 28 of milling tube 25. This fastening element 28 comprises e.g. an annular flange projecting radially inward from milling tube 25 and attached to the inner surface 44 of milling tube 25. This annular flange, as shown in Fig. 3, can be L-shaped in cross section, with an axially projecting ring segment or ring 42 radially supporting the milling tube 25 on the roller base body 19 in a fitting manner.

The radially inwardly projecting portion of the fastening element 28 is screwed by means of axial fastening screws to the front end 3 of the roller base body 19 so that the milling tube 25 is connected to roller base body 19 in a rotationally fixed manner. The roller base body 19 can abut, by its front side end 43 facing toward the movable bearing 24, on the fastening element 28 comprising the annular flange, without a gap 27 being formed.

On the outer surface 46 of the milling tube 25, milling tools (not shown) are mounted.

To adapt the road construction machine to different requirements at a construction site, only the milling tube 25 has to be exchanged. In this manner, milling tubes 25 of different working widths or with different line intervals of the milling tools for obtaining a different surface roughness of the road paving, can be used and quickly exchanged for other milling tubes 25.

For mounting the milling tube 25, the side wall 17 arranged on the movable bearing 24 is demounted or is pivoted through a hinge or a gear 30 as shown in Fig. 5. The hinge 30 or gear is fastened to the roller box 31. After pivoting

the side wall 17, the fastening screws of the fastening element 28 can be loosened, and the milling tube 25 can be exchanged by means of simple tools.

Fig. 4 shows a further embodiment for small working widths of the milling tube 25 wherein particularly the planetary gear 32 is arranged on the side of the roller base body 19 facing away from the drive. The planetary gear 32 is connected to the milling roller drive device 11 to 15 via a shaft 56 guided through the roller base body 19. The arrangement of the planetary gear 32 on the side facing away from the drive makes it possible that the milling tube 25 ends nearly flush with the machine outer edge (zero-side). When exchanging the milling tube 25, it is possible, after removal of the side wall 17, to shift the milling tube 25 over the planetary gear 32 until the fastening element 28 abuts the planetary gear 32.

On the end of the milling tube 25 facing away from the planetary gear 32, a radial support is provided for the milling tube in the form of a support ring 33 arranged between the milling tube and the roller base body 19 and consisting of a plurality of segment rings 60, 62, 64. The support ring 33 is axially displaceable both relative to milling tube 25 and relative to roller base body 19. The outer segment rings 62, 64 are conically beveled on the side radially facing toward the central segment ring 60, and the inclination of their conical faces is adapted to the central segment ring 60 having a wedge-shaped cross section. The central segment ring 60 is provided with fastening screws 35 cooperating with an annular or annularly segmented counterpressure plate 34 to thus clamp the outer segment rings 62, 64 against the central segment ring 60. By the expansion of the outer segment rings 62, 64, the milling tube 25 is tightly clamped to the roller base body 19 and is at the same time centered.

The interrupted lines indicate the maximum sectional circular diameter and the minimum milling width.

Figs. 6 and 7 illustrate an alternative radial support of the milling tube 25 on the roller base body 19. In this embodiment, as shown in Fig. 6, the fastening element 28 is in flush axial abutment on the end side 43 of roller base body 19 without a gap.

The free end of the roller base body 19 has a cylindrical guidance element 26 welded thereto, abutting in a closely fitting manner on the inner surface 44 of milling tube 25. Further, the inner surface 44 of milling tube 25 is on the free end of the tube protected by a protective sleeve 39 so that the material detached by the milling roller 25 cannot damage the inner surface 44 of milling tube 25. Preferably, the protective sleeve 39 is fastened to the planetary gear 32 by a flange.

Fig. 8 shows an alternative embodiment of the arrangement according to Fig. 4 wherein the fastening element 28 rests on a flange portion of the planetary gear 32 with close fit. A support ring 33 is screwed to the roller base body 19, and the roller base body 19 can be mounted on different axial positions depending on the length of the milling tube 25. For this purpose, the roller base body 19 comprises a protective tube 38 exchangeably mounted on the roller base body 19 in a rotationally fixed manner. The protective tube 38 serves for protecting the roller base body 19 from damage from the milled material. In the protective tube 38, recesses 37 are arranged in a uniform distribution at predetermined axial distances on the circumference, in which recesses the support ring 33 can be mounted to the roller base body 19. The axial distances of the recesses 37 are adapted to the lengths of different milling tubes 25. If no support ring 33 has been mounted, the recesses 37 are closed by a lid 36 so that also in the region of the recesses 37 no damage can be caused to the roller base body 19. Preferably, it is provided that the support ring 33 is combined with a protective sleeve 39 arranged to protect the inner surface 44 on the free end of milling tube 25.

Fig. 9 is a sectional view taken along the line IX-IX in Fig. 8. The support ring 33 consists of two halves which can be screwed tight relative to each other on the roller base body 19 by means of screws. In this arrangement, projections 35 of support ring 33 engage the recesses 37 of the protective tube 38. The support ring halves can be screwed to the roller base body 19 on the projections 35. For axial displacement of the support ring 33, the screws 47 are detached after removal of milling tube 25 so that the two halves of the support ring 33 can be pulled apart at least so far that the support ring 33 can be shifted over the protective tube 38. For spreading the two halves of the support ring 33 apart, use is made of pressing screws 48 so that the support ring 33 can be mounted without large force and time requirement on a different axial position on the roller base body 19 without detaching the screws 47 completely. The recesses 37 are axially arranged in the protective tube 38 in such a manner that the protective shell 39, coupled to support ring 33, for the inner surface 44 of the milling tube ends flush with the free end of the respective inserted milling tube 25.

## Claims

1. A milling roller comprising a roller base body (19) driven by a milling roller drive device (11 to 15) via a transmission unit (32), and a one-piece milling tube (25) to be coaxially mounted from one side on the roller base body (19) and to be attached in a manner allowing exchange thereof, the milling tube (25) carrying cutting tools on its outer surface (46), characterized in that the milling tube (25) comprises fastening elements (28), radially projecting from the inner surface (44) of the milling tube (25), by which the milling tube (25) can be mounted in a rotationally fixed manner to the roller base body (19) or to a member connected to the roller base body (19).
2. The milling roller according to claim 1, characterized in that the fastening elements (28) are arranged on at least one end side of the milling tube (25).
3. The milling roller according to any one of claims 1 or 2, characterized in that the milling tube (25) is fastened to an end side of the roller base body (19) and is radially supported on the other end side.
4. The milling roller according to any one of claims 1 to 3, characterized in that the fastening elements (28) comprise flange members projecting radially inward from the milling tube (25).
5. The milling roller according to any one of claims 1 to 4, characterized in that the milling tube (25) is arranged at a radial distance from the roller base body.

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6. The milling roller according to any one of claims 1 to 5, characterized in that the milling tube (25) axially projects relative to the roller base body (19).
7. The milling roller according to any one of claims 1 to 6, characterized in that the member connected to the roller base body (19) comprises the transmission unit (32) integrated into the roller base body (19).
8. The milling roller according to any one of claims 1 to 7, characterized in that the milling tube (25) is radially supported at two axially spaced positions on the roller base body (19).
9. The milling roller according to claim 8, characterized in that the support comprises radial guide elements (26;33;42) fastened either radially outside on the roller base body (19) or radially inside on the milling tube (25) or are arranged between the roller base body (19) and the milling tube (25).
10. The milling roller according to claim 8, characterized in that the support comprises radial guide elements (42), wherein the guide elements (42) are integrally connected to the at least one fastening element (28).
11. The milling roller according to claim 9, characterized in that the support comprises radial guide elements (26), wherein the guide elements (26) are arranged on the free end side of the roller base body (19).
12. The milling roller according to any one of claims 9 or 11, characterized in that the radial guide elements can comprise radially acting tensioning elements (60,62,64).

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13. The milling roller according to any one of claims 1 to 12, characterized in that, between the milling tube (25) and the roller base body (19), at least one support ring (33) is arranged as a radial guiding element.
14. The milling roller according to claim 15, characterized in that the at least one support ring (33) comprises at least two radially tensioned segment rings (60,62,64).
15. The milling roller according to claim 13 or 14, characterized in that the at least one support ring (33) is arranged for axial displacement relative to the roller base body (19) and the milling tube (25).
16. The milling roller according to claim 14 or 15, characterized in that the segment rings (62,62,64) are wedge-shaped in cross section.
17. The milling roller according to any one of claims 13 to 16, characterized in that the at least one support ring (33) comprises a central ring (60) having a trapezoidal shape in cross section and arranged to be axially tensioned against a radially outer ring (62) and a radially inner ring (64) which have an opposite trapezoidal shape in cross section, and pressing the outer ring (62) against the milling tube (25) and the inner ring (64) against the roller base body (19).
18. The milling roller according to any one of claims 13 to 17, characterized in that the at least one support ring (33) is divided into two or more parts in the circumferential direction.
19. The milling roller according to any one of claims 1 to 28, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing toward the milling roller drive device (11 to 15).

20. The milling roller according to any one of claims 1 to 18, characterized in that the transmission unit (32) is arranged at the end of the roller base body (19) facing away from the milling roller drive device (11 to 15), the transmission unit (32) being connected to the milling roller drive device (11 to 15) by a shaft (56) guided through the roller base body (19).
21. The milling roller according to any one of claims 1 to 20, characterized in that the roller base body (19) is supported in two side walls (16,17) of a roller box (31), that the side wall (17) facing away from the milling roller drive device (11 to 15) can be displaced by a pivoting or axis-parallel movement, and that the pivotable side wall (17) in the closed condition receives the movable bearing (24) of the roller base body (19).
22. The milling roller according to claim 21, characterized in that the movable bearing (24) comprises an outwardly tapering guide member (40) and that the side wall (17) comprises a correspondingly tapering recess (41) receiving the guide member (40).
23. The milling roller according to any one of claims 1 to 22, characterized in that the roller base body (19) is supported in two side walls (16,17) of a roller box (31), that a machine cover (21) arranged on the milling roller drive device (11 to 15) is provided with openings (23) allowing access to fastening elements (20) between the side wall (16) facing toward the milling roller drive device (11 to 15) and the transmission unit (32) without a demounting of machine parts.
24. The milling roller according to any one of claims 1 to 23, characterized in that the free end of the milling tube (25) is provided with a protective sleeve (39) for the inner surface (44).
25. The milling roller according to claim 13 and 24, characterized in that the protective sleeve (39) projects from the support ring (33).

26. The milling roller according to any one of claims 1 to 25, characterized in that the roller base body (19) is surrounded by a protective tube (38).
27. The milling roller according to claim 13 and 26, characterized in that the protective tube (38) comprises recesses (37) arranged in a uniform distribution at predetermined axial distances on the circumference, for receiving the support ring (33).
28. A construction machine, preferably comprising a machine frame (2) having a milling roller (18) according to any one of claims 1 to 27 arranged or supported therein.

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FIG.1

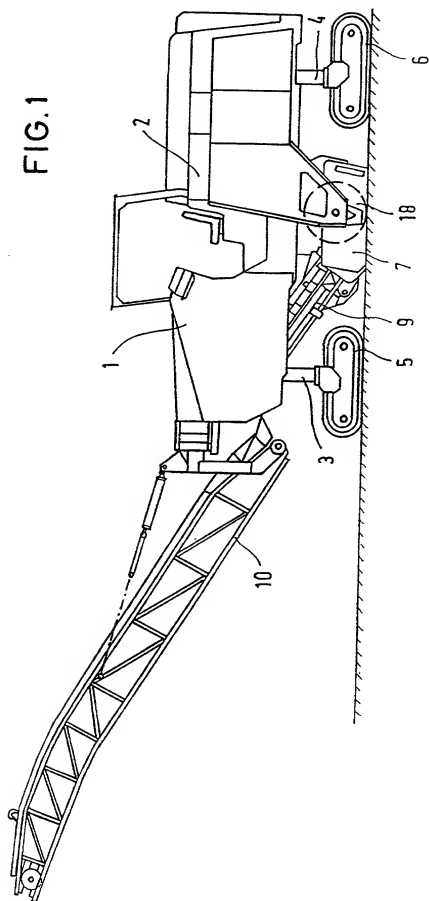


FIG. 2

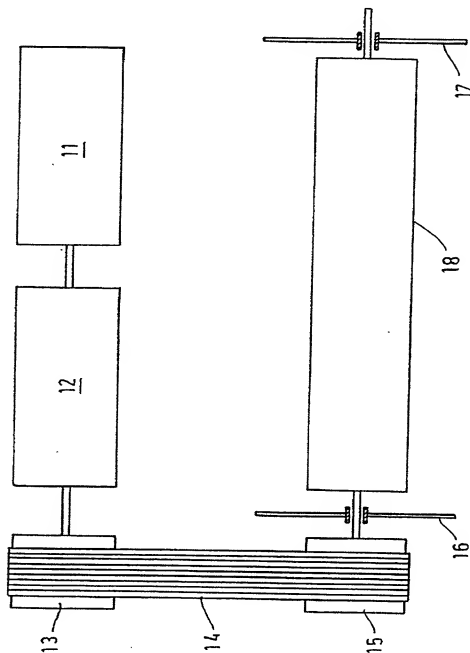
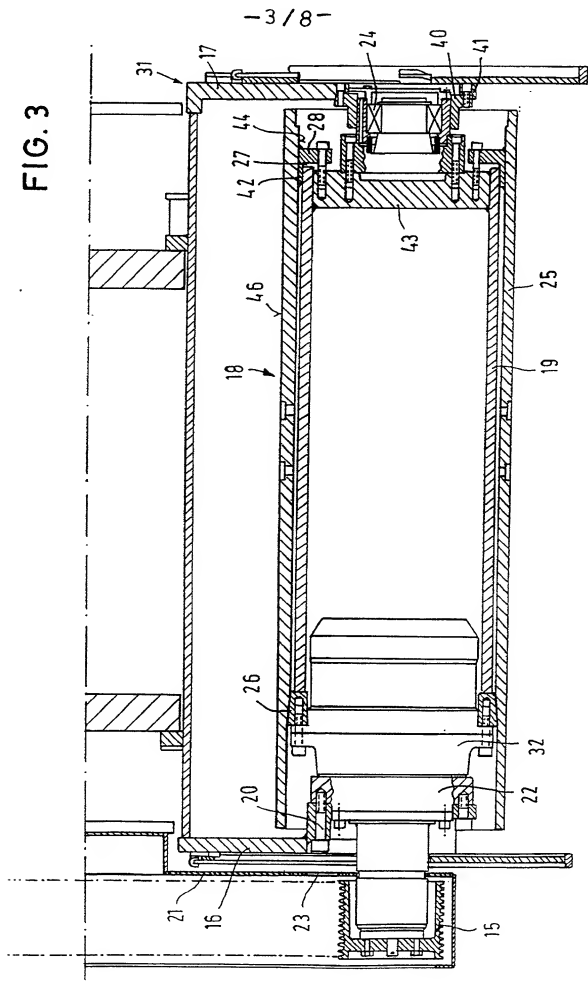


FIG. 3



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FIG. 4

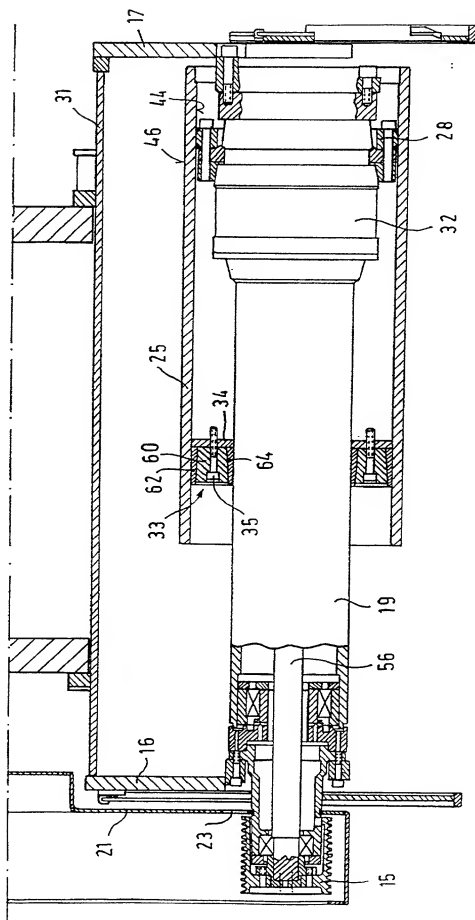


FIG. 5

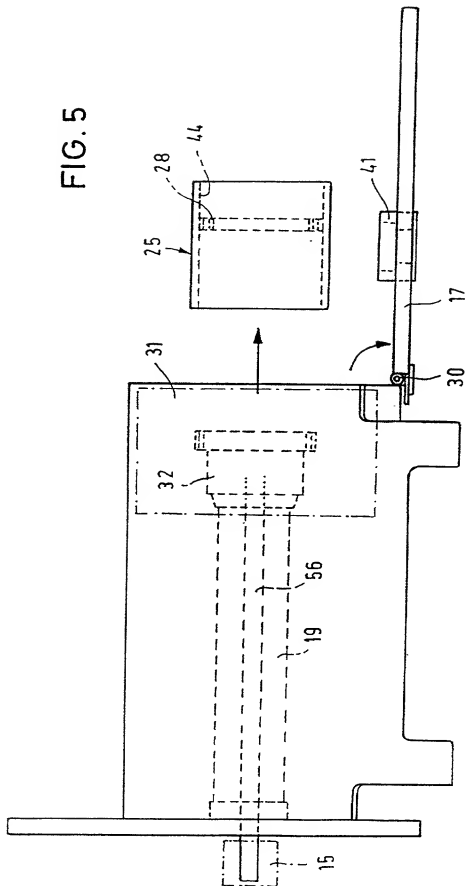


FIG.6

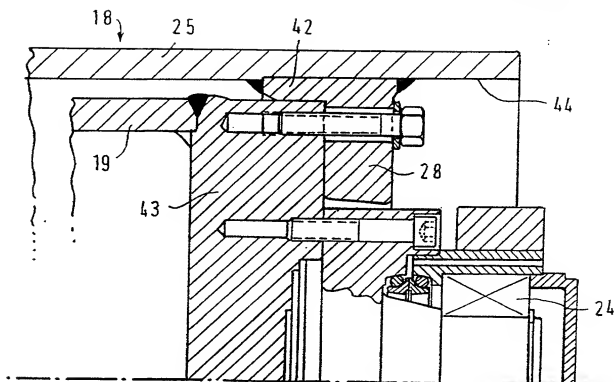


FIG.7

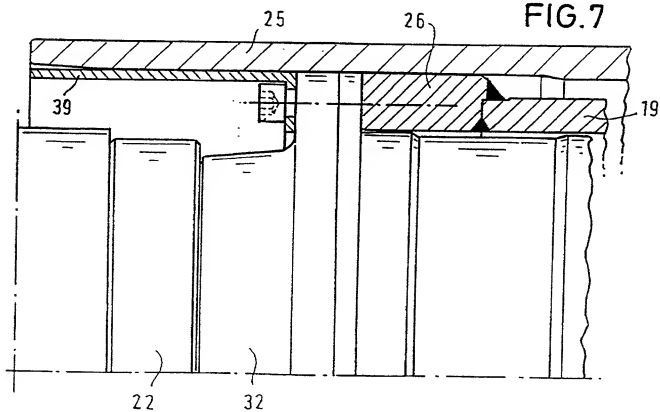
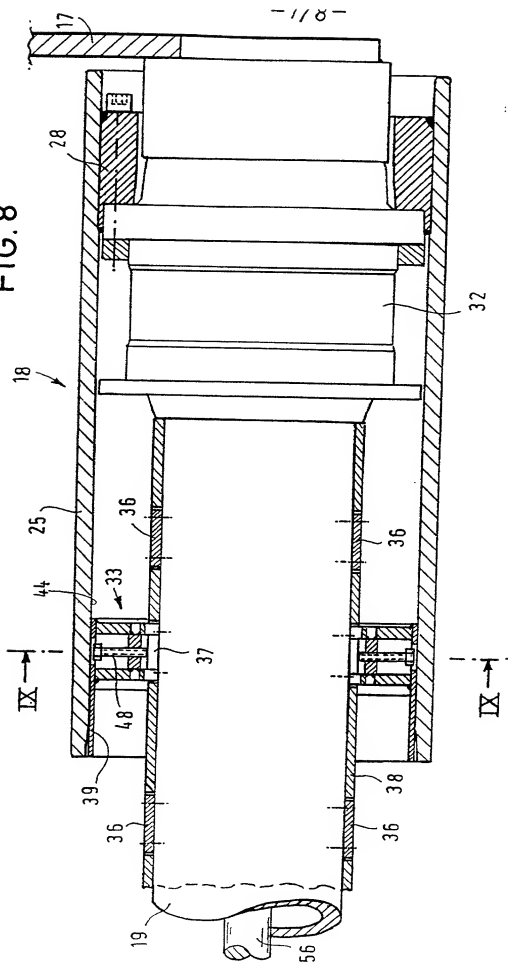


FIG. 8



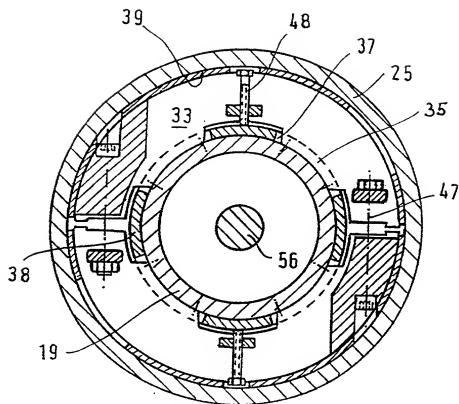


FIG. 9

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**COMBINED DECLARATION AND POWER OF ATTORNEY  
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Invent Title

As a below named inventor, I hereby declare that: my residence post office address and citizenship are as stated next to my name; that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: \*

Construction machine and milling roller

Check Box If  
Appropriate --  
For Use Without  
Specification  
Attached

the specification of which is attached hereto unless one of the following boxes is checked:

- ☐ The Specification was filed on \_\_\_\_\_ and was assigned  
Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_  
☒ was filed as PCT international application number PCT/EP00/06715 on  
July 14, 2000 and was amended under PCT Article 19 on \_\_\_\_\_  
(if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof, or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (six months for designs) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows:

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below:

Prior Foreign Application(s)

Priority Claimed

<u>199 32 396.8</u>	<u>Germany</u>	<u>July 14, 2000</u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/ Day/ Year Filed)		
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/ Day/ Year Filed)		
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/ Day/ Year Filed)		
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/ Day/ Year Filed)		
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/ Day/ Year Filed)		

All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More Than 12 Months (6 Months for Designs) Prior To The Filing Date of This Application:

Country	Application No.	Date of Filing (Month/ Day/ Year)
<u>                    </u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

<u>                    </u>	<u>                    </u>	<u>                    </u>
(Application Serial No.)	(Filing Date)	(Status — patented, pending, abandoned)
<u>                    </u>	<u>                    </u>	<u>                    </u>
(Application Serial No.)	(Filing Date)	(Status — patented, pending, abandoned)

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I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary:

**Vincent L. Ramik - Registration No. 20,663**

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**Merrion Square Suite 101**  
**7345 McWhorter Place**  
**Annandale, Virginia 22003**  
**Telephone (703) 642-5705**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of First or Sole Inventor: Insert Name of Inventor Insert Date This Document is Signed Insert Residence Insert Citizenship Insert Post Office Address	GIVEN NAME <b>Olaf</b>	FAMILY NAME <b>GAERTNER</b>	INVENTOR'S SIGNATURE <i>[Signature]</i>	*DATE <b>14.11.2001</b>
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Full Name of Third Inventor, if any: see above	GIVEN NAME <b>Bernd</b>	FAMILY NAME <b>HOLL</b>	INVENTOR'S SIGNATURE <i>[Signature]</i>	*DATE <b>14.11.2001</b>
	RESIDENCE (City, State & Country) <b>53577 Neustadt/Wied, Germany</b>		CITIZENSHIP <b>German</b>	
	POST OFFICE ADDRESS (Complete Street Address including City, State & Country) <b>Herrengarten 49, 53577 Neustadt/Wied, Germany</b>			
Full Name of Fourth Inventor, if any: see above	GIVEN NAME	FAMILY NAME	INVENTOR'S SIGNATURE	*DATE
	RESIDENCE (City, State & Country)		CITIZENSHIP	
	POST OFFICE ADDRESS (Complete Street Address including City, State & Country)			
Full Name of Fifth Inventor, if any: see above	GIVEN NAME	FAMILY NAME	INVENTOR'S SIGNATURE	*DATE
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